

A08835

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Hochbaum & Bessen, in press

1965

WATERFOWL RESEARCH—ACCOMPLISHMENTS, NEEDS, OBJECTIVES

H. ALBERT HOCHBAUM

Director, Delta Waterfowl Research Station, Delta, Manitoba and

EUGENE F. ROSSENMAIER

Manitoba Department of Mines and Natural Resources, Winnipeg

Through the years since man became curious of his surroundings he has discovered a great deal about the wild ducks, geese and swans that share his environment. The sum of this knowledge now in print is impressive. Indeed, except for the domestic fowl, there is no group of birds more completely discussed in literature than waterfowl.

Patient explorations year by year have located the breeding ranges of waterfowl; and after World War II our knowledge of the spread of ducks in spring and summer became thoroughly refined. These post-war studies exploded some myths about the sources of waterfowl, and we were brought to realize that the proverbial "north," from which came the annual flow of ducks, was the farmland of prairie states and provinces.

In the 1930's, studies of breeding behavior revealed how nesting pairs became isolated by sexual strife. This understanding created a new outlook for management. It became clear that many square miles were required to produce a flock of ducks; that a wilderness marsh could hold no higher densities of pairs than slough and pothole country in rich agricultural land.

The paired distribution of ducks induced research in census tech-

niques; birds were much easier to count in small groups than in flocks. The surveys of the past 19 years have shown where each kind thrives. We know nearly as much about the density of prairie waterfowl as we do of domestic stock. Moreover, there is a clear record of their ups and downs as drouth, drainage and other changes in habitat caused shifts and declines in population. Studies of waterfowl on their wintering grounds have rounded out the picture; we know where most of the North American ducks live the year around.

On the basis of mass bandings, reinforced by intensive studies of visible migration and tracking with radar, we know when waterfowl migrate, their routes and destinations. Main passages can be predicted through an analysis of weather data. Such knowledge has become of increasing importance as we learn that ducks cannot be managed as though they were all Mallards; that, species by species, there are important differences in timing, in resting places and in destinations, so that as pressures of civilization increase, the need for special attention for some kinds becomes ever more important.

The significance of hunting as a mortality factor and the influence of individual regulations on the total kill have received increased attention. In this work, great masses of data derived from banding programs and hunter-harvest studies have been analyzed by the biostatistician, a relative newcomer to the waterfowl research field.

All waterfowl adapt well to captivity, hence their sex and age characteristics, their breeding behavior and their reproductive potentials are understood far better than in most families of birds. Perhaps there is a lesson to be read in the fact that some of the techniques for captive breeding, especially of rare North American species, as the Trumpeter Swan, or declining birds, as the Canvas-back, are more highly developed in Europe.

We have enlarged our knowledge of waterfowl ecology. Environmental situations available to ducks and geese for breeding, migration and wintering have been examined to explain degrees of use and non-use. We understand much more of the needs and tolerances of waterfowl for food, cover, water and security. Prescribed burning, regulated grazing, supplemental feeding, controlled water levels, artificial nesting sites, and strategic placement of refuges are but a few of the tools now employed on intensively managed areas. Drastic changes in habitat caused by moisture cycles, hurricanes and human activities during the past 20 years have afforded opportunities to study the effects of major alterations in environment on waterfowl. We now are better able to anticipate and explain natural ups and downs in waterfowl numbers, shifts in distribution and changes in behavior.

This has not been an exhaustive review of accomplishments in waterfowl research; our purpose has been simply to show that knowledge of waterfowl has reached an advanced state. But it is commonly agreed that fact finding has not kept pace with needs.

Research calls for curious men with the time and the means to examine their surroundings. In waterfowl biology, the needs of research never before have been met so bountifully. Where one man gave full time to research before the war, 20 or 30 biologists now devote their energies to waterfowl studies. Where there were only hundreds of dollars, we now have many thousands.

What needs should be met by this expanding effort? We claim no monopoly on ideas. In preparing this paper we have referred to several of the processed briefs outlining research needs that have been turned out during the past three years by committees of United States and Canadian biologists (Mississippi Flyway Council, 1962; U. S. Fish and Wildlife Service, 1964; U. S. Fish and Wildlife Service and Canadian Wildlife Service, 1962). Our concern in this discussion is not a close look at needs per se but rather an examination of the current state of waterfowl research, for here, we believe, are to be found clues to its productive future.

Clearly there is a requirement for improved communication between research and management. Research biologists must do a better job of making the results of their studies available for others. Publication not only accomplishes this end; it also gives evidence and discoveries the benefit of scrutiny by men of varied experiences and outlooks the world over. And when a scientist is obliged to place his results in the open where they may be examined by his colleagues, he adjusts to a disciplined analysis of his work that comes about in no other way; he learns the truth of his findings through this ordeal. By not publishing the meet of his data, the research biologist is doing little more than whispering in his own beard.

There is a fundamental need not only for publication of current research, but for consolidation of the mass of raw data already in hand. For example, many of the findings gathered by cooperating agencies in the waterfowl breeding ground surveys of the past 19 years are difficult to use in their present form. Some *Special Scientific Reports* holding this material are out of print and are not widely available in libraries. These records should be condensed, analyzed and published while workers who gathered the material are still active. How can we plan for tomorrow without a clear view of where we are today?

Back in the 1930's, the need for presenting the results of research before the lay public was frequently stated. Here is one field where

great advances have been made during the past 20 years. Many of the states are keeping their public informed through popular fish and game magazines and semi-technical bulletins. The caliber of writing is often excellent and the results of research reported in clear, simple language. The Fish and Wildlife Service and the Canadian Wildlife Service have produced several popular bulletins on their activities, and now we have *Waterfowl Tomorrow*, (Landuska *et al.*, 1961), a grand compendium of information on many phases of waterfowl management and research.

There is need for socio-economic studies of our waterfowl resources. "Under democratic systems the ultimate judgments of what is good and what is bad about the utilization of resources and the goals thereof are products of public opinion" (Kelson, 1955). Studies are needed relating waterfowl and their marshes to the society of man, this requirement intensified by the differences in public opinion on waterfowl conservation that now exist between Canada and the United States. Surely the overall plan for waterfowl research should make use of disciplines other than biology to sort out the forces at play and to provide the necessary social and economic foundations for the preservation of waterfowl resources.

Data on breeding-ground densities in the United States indicate that less than two per cent of game ducks nest on refuges and other public lands (Crissey *et al.*, 1951; Williams *et al.*, 1950). Similar conditions prevail on the Prairie Provinces. Socio-economic studies may point to ways and means for creating new incentives for the preservation of breeding habitat on private farmland.

In this same field there is need for a continuing program of research in the relation of the hunter to his game. Through the long steady decline of the hunter's privileges, the general idea seems to have been that some good must result simply by tightening the screw. Now we have a mass of laws that restrict freedom but possibly without commensurate savings of birds. Good laws effectively enforced are waterfowl management's oldest and most useful tools. Law, it has been said, is the "science of liberty" (Bendaut, 1891). Surely it must be possible, through research, to conserve our waterfowl under sound, enforceable laws which at the same time take into account the dignity of human freedom.

There is need for more intensive studies of the potential of local waterfowl habitat. Minnesota, Wisconsin and New York State are examples of jurisdictions that have pioneered here. An awareness of the productive capabilities of native wetlands must come about if wildfowling is to survive. In the United States, there has developed the habit of looking ever north for the bulk of our supplies; and this has held in Canada as well. But there is evidence that the combined

home product of each state and prairie province makes up most of the entire flight. Knowledge of local waterfowl will incite concern for local populations, a step toward more efficient management of the resource as a whole.

There is a need to study the bird itself. Waterfowl research since the war has developed as a science of counting, but we simply do not know enough about the birds we tally. To balance expenditure of hundreds of thousands of dollars for survey, there is not enough spent on studies of the bird—good old-fashioned life-history studies benefiting by new techniques in hand. There remain many mysteries about the common Mallard, for instance, that must have bearing on its welfare and management. And the Mallard is but one of 30 species of ducks on our shooting regulations today. Direct study of the bird itself should be encouraged at all levels—in graduate school, by university faculty, by state, provincial and federal offices.

There appears to be a need for better rapport between waterfowl biologists and colleagues in closely related disciplines. Most noticeable is the gap between waterfowl men and ornithologists studying other birds, but there is also a failure to become familiar with many other closely related sciences. Such voluntary isolation separates our field from newly discovered truths close to our problems. We are becoming detached from sources of information vital to the welfare of the resources we hope to manage.

There is a need to revitalize the study of waterfowl diseases. This will come about, doubtlessly, as total supplies dwindle and the impact of non-hunting mortality is more fully realized. But we must not let the priorities of habitat preservation and species management dull our concern for disease. Botulism almost every summer claims a shocking number of birds. It would not surprise us to learn, if all the facts were available for analysis, that botulism losses for some recent years in Manitoba approached 50 per cent of the legal harvest. Yet a complacent or defeatist attitude seems to have developed toward botulism, and this just at the time when Bell, *et al.* (1953) have produced the tenable microenvironment concept, when Cooch (1964) has shown a possible involvement of the salt gland, and when pharmacology has made important strides with antibiotics. Botulism research, we believe, is at the threshold of its most important discoveries, but new stimulus is needed.

There is a renewed interest in lead poisoning, but fowl cholera remains an enigma commanding little attention. Algal poisoning is still a mystery, but basic research is being carried forward by plant physiologists and public health scientists far removed from the waterfowl field. There is evidence that some diseases are increasing due to

impact of man's ever-growing role in the ecology of waterfowl habitat. If the actions of man increase the incidence of diseases, there must be some steps he can take to reduce or control these outbreaks.

There is a need for every organization that is carrying out waterfowl research to evaluate the effectiveness of its research program. Aldo Leopold (1948), before this same Conference 17 years ago, said, "Fumbling during the first decade of wildlife research may be explained—and dismissed—as growing pains." He admitted, "All of us fumbled, more or less, in the early days." Then he added, "None of these alibis for fumbling exist today. To reduce fumbling is our most important job." The waterfowl research effort of 1965 is much more impressive in terms of size than that of 1948, but is it relatively more proficient?

To answer this question will require each sponsoring agency to compare its research program with the accepted standards for sound research administration. Useful guiding principles, recently laid down by Dr. L. J. Lyon (1963), emphasize that successful research requires competent personnel working in an inspired atmosphere under a skilled research director within a framework that produces a continual flow of ideas from the individual scientist to senior management.

What is the best starting point for improving a research organization? The basic ingredients of good research can be listed, and treating one or another of them separately will occasionally help. But we believe that the key to the solution is at the top—that by insisting on sound principles of scientific procedure, administration will build a stronger, more efficient and useful research organization while at the same time attracting well-trained young men disciplined in the traditions of science.

OBJECTIVES

There is considerable misunderstanding regarding the relation between scientific research and the need for practical information by management. Science does not scorn the practical. Indeed, research thrives only where its products contribute usefully to human development. But we must resist shortcutting in the name of practicability. This tends to lead research down narrow trails while at the same time well-trained scientists are induced to find employment in other fields.

Practical goals themselves are not out of order. Columbus' journey across uncharted seas is an outstanding example of basic research. His objective was India and he had practical reasons for seeking this goal. But research, like Columbus' discovery of America, which could